The Weather in the West

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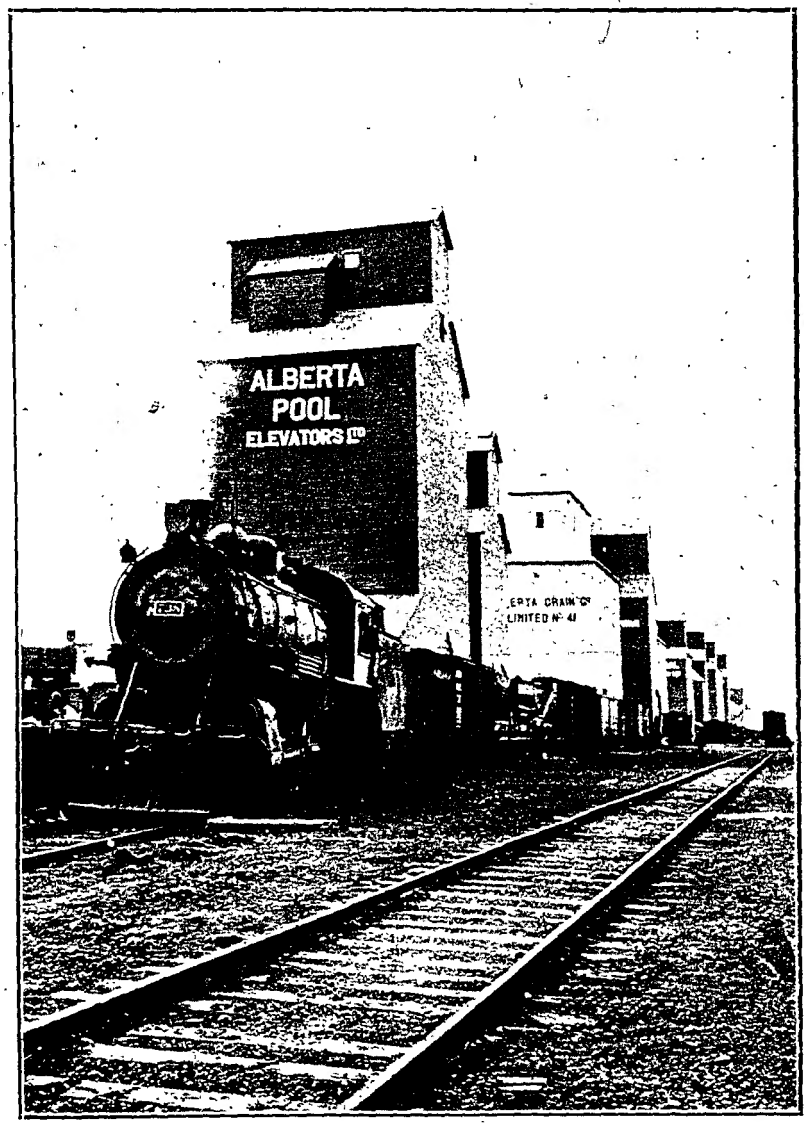


Country Elevators at Vulcan, Alberta.

The Weather in the West

Western Canada, between the Rocky Mountains in the west and the Province of Ontario in the east, is a region of scanty rainfall. The treeless prairie portion of the west is more drouthy than the wooded areas in the central and northern regions. These prairies are part of a series of plateaux on the eastern side of the Rocky Mountains extending as far south as Mexico. This entire region is one of low precipitation, being characterized, more particularly in Mexico and the southern part of the United States, by deserts. The extreme droughty portion of this region extends into Canada for only a comparatively short distance.

WHEAT IS DROUTH RESISTENT

Of all the widely cultivated grains, wheat is the most drouth resistant. It will produce more pounds of grain per acre under drouth conditions than any other cereal. As a consequence wheat is the most economical crop for farmers to grow in Western Canada. Further, the long days of sunshine and the cool nights, so characteristic of the west, combined with the light rainfall, produces a hard spring wheat that has a high protein content, for which, under normal conditions, there is usually a good demand in world markets. This type of wheat is utilized by importing nations to give strength to the soft, white wheats with which it is blended. Strong, hard wheat cannot be produced in areas of heavy rainfall, but the problem that annually confronts the prairie wheat farmer is whether or not the season's rainfall will be too scanty to produce wheat in sufficient quantity to make its culture a profitable venture.

RAIN COMES FROM THE SOUTH

The prairie regions of Western Canada are prevented by the Rocky Mountains from obtaining rainfall from the Pacific Ocean. Moisture from the Arctic Ocean and Hudson's Bay is not available for meteorological reasons that need not be dwelt on here. The fact is that Western Canada's rainfall actually comes from the Gulf of Mexico, some 1,500 miles to the south. It is carried on the warm winds which drift northward during the spring and summer months. Cold winds from the northeast and northwest, encountering the warm moisture-laden breezes from the south, force them to higher and colder

altitudes. As the warm air rises it cools rapidly, losing as much as 30 degrees. The cooling brings about a condensation of the moisture which falls in the form of rain. The higher the warm air is shoved by the cold air, the more moisture it loses and the heavier the rainfall. A 10-foot cube of saturated warm air with a temperature of 80 degrees F. carries a load of 25 ounces of water. A drop of 30 degrees in temperature will cause the loss of two-thirds of its moisture.

The cold winds from the Arctic must encounter the warm, moist winds from the south in a surrounding manner in order to bring about rainfall. The ideal arrangement to provide rain is a simultaneous advance of cold air from the northwest and northeast to encounter the southern winds over the prairies with both extremities of the northern winds performing an encircling movement on both flanks of the southern winds. It will thus be realized that very nice synchronization is required for a general rain to fall on the prairies. That is one important reason why rainfall is so scanty here.

Of recent years the southern breezes have changed their position and instead of coming warm and moisture-laden from the Gulf of Mexico they are emerging from somewhere in the interior of Mexico and carry very little moisture. The Alberta Drouth Commission's report (1935-36) points out this fact and remarks that no one knows why this meteorological change has occurred but it actually has done so. Evidence is available to show that this has happened in the past and will probably occur again in the future.

PRECIPITATION ON THE PRAIRIES

For untold ages weather conditions, similar to those which have been experienced since settlement on the prairies commenced, have persisted in this region. The absence of trees on the prairie, the short native grasses and the character of the soil, prove definitely that for centuries this was an area of low rainfall. An examination of the soil of Southeastern Alberta shows it to be a light brown in color. This proves that the organic matter (or plant material) produced has always been scanty. The top growth over the years has never been sufficiently luxuriant to blacken the soil such as is the case in regions where rainfall is abundant. The absence of trees is another indication of deficiency of moisture. Trees are a product of rainfall and not the cause of it. If by some miracle the entire prairie regions could be treed tomorrow, rainfall would not be increased a particle. Over a period of years most of the trees would die from lack of moisture.

In Southeastern Alberta a large part of Western Saskatchewan and generally in the northern regions of all three provinces the annual precipitation averages less than 15 inches. In a portion of Southeastern Alberta and of Southwestern Saskatchewan, where spring comes early, autumn late and the heat of the summer is often intense, the average annual rainfall is between 10 and 12 inches. In a strip close to the Rocky Mountains of Southwestern Alberta, in the upper valleys of the Red Deer River and its tributaries, as well as in a large portion of the basin of the North Saskatchewan River, and in the basin of the Athabasca River 15 inches of rain is generally exceeded. In the extreme southwestern portion of Alberta the annual amount averages 20 to 30 inches. In the foothills of Alberta and also in the Peace River country and the region from Lesser Slave Lake to Edmonton good rains may occur while the central regions suffer from drouth. This appears to be due principally to two reasons. Warm, moisture-bearing air which has passed over the central regions may meet a cool environment in the northern latitudes or in the higher elevations of the foothills, although this cool environment lacks sufficient energy to advance further south. At times also moisture-bearing air invades the territory from the Northern Pacific Ocean and rises with dynamic cooling over a very limited area. In hilly regions such as Cypress Hills and the Hand Hills scattered thunder storms will occur due to local extension of tongues of cool air from the hills when the conditions for rain are not sufficiently advanced for a general downpour over the prairies.

THE INCIDENCE OF ANNUAL RAINFALL

It is fortunate for the west that from 60 to 70 per cent. of the annual precipitation occurs from April 1st to August 31st, and approximately one-half of the annual amount in June, July and August. There is a tendency for the maximum raininess of the year to be reached from May 15th to June 15th in the extreme southwest corner of Alberta, from June 1st to June 15th in Southern Alberta and Southwestern Saskatchewan, from June 15th to July 1st in the central portion of the grain belt, and from July 1st to July 15th along the northern margin of the grain belt. Beyond the present region of general agriculture the peak of the rainy season comes later. This northward advance of the rain peak is, however, only recognizable in averages and is of no value for purposes of weather forecasting.

If the prairie regions had as abundant rainfall as the other Canadian provinces they would not be treeless plains,

nor could they grow hard, high protein, spring wheat. They would be forested regions and agriculture would advance only as fast as the axe of the woodsman or settler could clear the land. The tremendous expansion in agriculture over the past thirty years could not possibly have taken place. The increase in wheat acreage alone in that period has been approximately 15 million acres and similarly large increases have been made in the acreages devoted to oats, barley and rye.

A COMPARISON OF RAINFALL

A comparison between the rainfall in the region under discussion and that of the rest of Canada shows a striking difference. The following statistics are taken from records of from thirty-four to fifty-one years in different localities in the west:

	Inches.
Regina, Sask.	12
Saskatoon, Sask.	11 1/3
Moose Jaw, Sask.	11 1/3
Calgary, Alta.	13
Lethbridge, Alta.	11 4/5
Medicine Hat, Alta.	9 4/5

The long-term average annual precipitation in other parts of Canada is given herewith:

	Inches.
Vancouver, B.C.	58
Belleville, Ont.	35
London, Ont.	38
Sherbrooke, Que.	37
Kemptville, N.S.	38

MOISTURE REQUIREMENTS OF WHEAT

The question may naturally arise as to how much rainfall is necessary to produce a good crop of wheat. It has been calculated that it requires an average of 40 tons of water, or 200 barrels, to produce one bushel of wheat on summer-fallowed land. One inch of rainfall over an acre is equivalent to 113 tons of water. Each inch of moisture available to a growing crop has resulted in an average yield from summer-fallowed land of 2.84 bushels. Thus 10 inches of rainfall available to a wheat crop on summer-fallow should produce 28 bushels of wheat to the acre. That statement is only relatively true. Timeliness of rainfall is very important and there are other factors such as wind and heat which take

an enormous toll of moisture from the soil through evaporation. Chinook winds are very dry, containing only about 15 degrees of humidity at the ground. Such winds, blowing for a few days, dry out the land to an alarming extent. Other countries with a more humid atmosphere can get by with average rainfall because the moist air does not capture any large amount of moisture from the ground. Germany is a striking example of this.

TIMELINESS OF RAIN IS IMPORTANT

As to the timeliness of rainfall a comparison of the years 1914 and 1915 furnishes an outstanding instance of what is liable to happen in the west. In one census division of the southern prairies in 1914 the yield was 2 bushels of wheat to the acre on all the land under cultivation, and the rainfall for the year was 12.53 inches. In 1915 the rainfall for the year was 16.30 inches, about 3½ inches more than in 1914, yet the yield in this district was 31 bushels to the acre. In 1928, when Western Canada produced its all-time record crop of 565 million bushels, the rainfall in Saskatchewan, which produced 321 million bushels, was around 12 inches. These statistics demonstrate the urgent need of timeliness in rainfall to produce a good wheat crop. I would say that 8 inches of rain, falling between the 24th of May and the 15th of July, with the downpours coming at intervals from one to two weeks, will produce a good crop of wheat on summer-fallow which has carried a fair reserve of moisture from the preceding year.

STORING MOISTURE

The main reason for summer-fallowing land in this country is to store moisture. By this method two year's moisture is made available for the crop. Fallow land is cultivated to prevent weeds growing and absorbing the moisture. Weeds take a heavy toll of moisture if allowed to grow on summer-fallow or competing with growing crops. Every weed means a reduction of crop yield because grains can utilize all the moisture in the land. During the growing season each year, deep beneath the ground, constant warfare is waging between the root systems of grain and weeds. The wild mustard plant has a root system of around 4,000 linear inches as against 2,000 for Marquis wheat. Hannchen barley has a root system of 4,674 linear inches. This extensive root system shows why barley is more successful than wheat in combating weeds.

THE PALLISER TRIANGLE

Between 1857 and 1860 Captain John Palliser, an Irishman in the service of the British government, was given charge of an expedition to explore the Canadian prairies and Rockies. An exhaustive scientific survey was made of large areas of the country, the results of which were set out in a report to the British government made in 1860. In this report Captain Palliser made casual mention of a vast, arid area on the high plains of inland North America. By inference he places the greater part of this area in the United States and comments: "This central desert extends, however, but a short way into British territory, forming a triangle having for its base the 49th parallel from longitude 100 to 114 west with its apex reaching to the 52nd parallel of latitude." This, it must be admitted, is a rather nebulous outline, and students of the subject have come to different conclusions as to the boundaries of this triangle. In my opinion the true Palliser triangle has its base on the 49th parallel and runs northeast from Waterton Lakes, Alberta, to a point on the 52nd parallel of latitude near Coronation, Alberta, the other side running southeast to a point on the 49th parallel directly south of Brandon, Manitoba. This is a proper triangle and not like the pentagon which other students of the subject have mapped out as the actual Palliser triangle. It corresponds well with the drought area in Alberta, but the experience of the years shows that the triangle's outline, as far as Saskatchewan is concerned, may well be modified to the extent that a considerable area around Moose Jaw and Regina and to the south of those cities might well be left out.

Much has been said and written about the Palliser triangle in Western Canada, and some have gained the impression that its scope is much wider than it really is and that Captain Palliser utterly condemned the bulk of the prairie regions as unfit farming country. As a matter of fact Captain Palliser's comments concerning the agricultural possibilities of the country he journeyed over were meagre. True, the drier areas and lighter lands within the triangle's boundaries have proven to be uneconomical for anything but range. But there are districts therein that are steady and persistent producers of large quantities of grain over the years. Only in seasons of exceptionally low precipitation, such as in 1936 and 1937, have these better areas in this triangle suffered severely.

MISCONCEPTIONS REGARDING WESTERN FARMERS

The idea that western wheat farmers are largely soil miners whose profligate practices have ruined their land is

not true. The great majority of western farmers are highly skilled and adaptable men who are keenly alive to the uncertainty of grain production and have striven to the extent of their ability and capital to make their occupation more secure. The history of agriculture in Western Canada is brief. Scarcely a generation has passed since most of the original prairie sod was turned under by the plow. Naturally the men who settled this land followed the practices of farming developed in the regions from whence they came. There were no available precedents for farming on the Canadian prairies. Gradually, with the education that only experience can give, and with the invaluable aid of scientists and technical agriculturists, improved methods for farming the prairies are being developed.

SOIL DRIFTING

It is now obvious that the true drouth area in the west, whose boundaries can be well defined, should never have been settled. Its colonization was a mistake. But were the farmers exclusively to blame? It is also plain to be seen that land which has been cropped for a number of years to grain must be carefully handled or it will blow away. Dr. Wyatt, of the University of Alberta, calculates it would take from $200 to $350 in commercial fertilizer to restore lost nitrates and phosphates caused by the blowing away of an inch of soil over an acre of fertile prairie land. But there was no soil blowing in the home lands of most of our settlers, namely, Eastern Canada, Great Britain, continental Europe and Eastern and Central United States. Measures will have to be adopted to restore humus and fertility to the soil and that is not easily done. How can legumes, which require abundant moisture for good growth, be grown when even the drouth-resistant wheat will not grow?

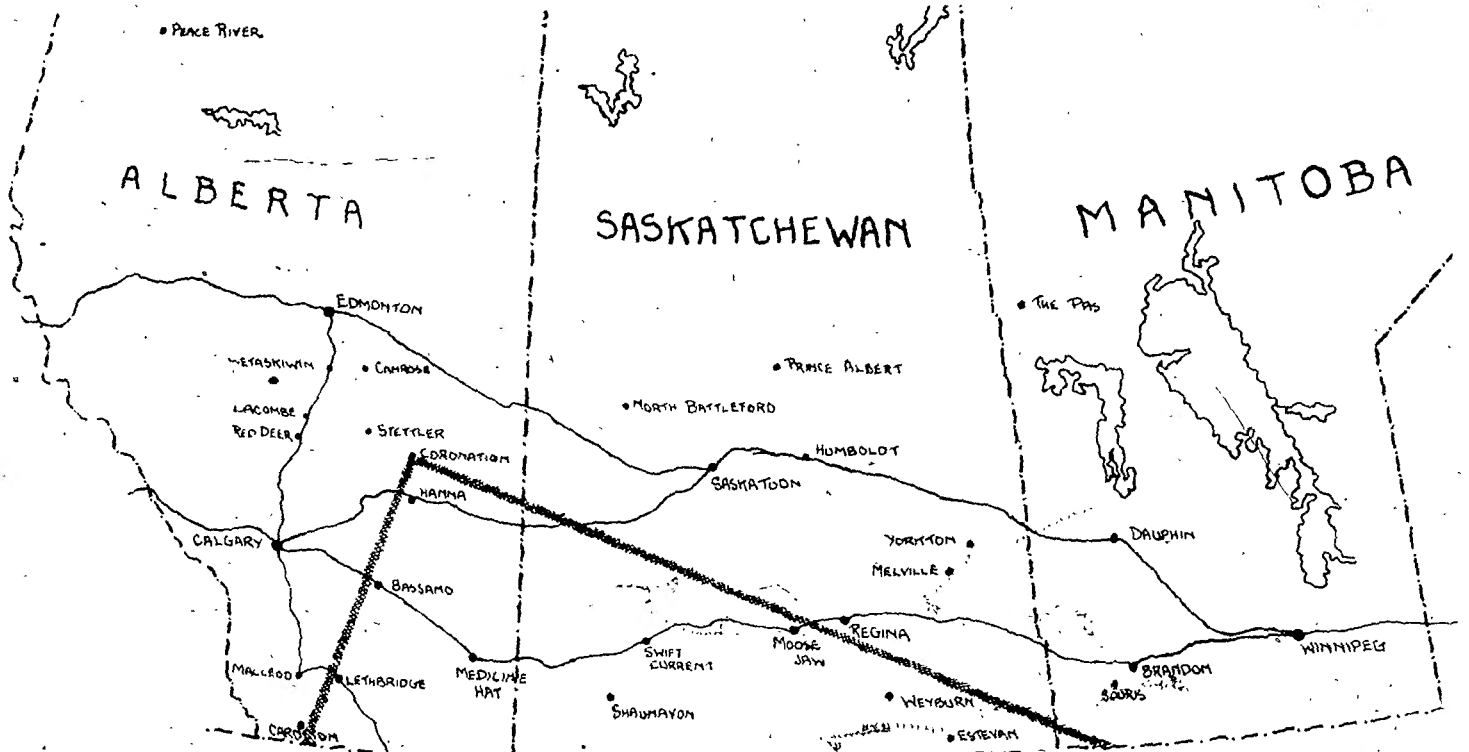
WEALTH PRODUCTION IN THE WEST

Whatever may be said of the short-sightedness of the western farmers they have provided for the pages of history a record of production of agricultural wealth unparalleled in the history of the world. From 1910 to 1936, inclusive, western farmers have produced 7,728,000,000 bushels of wheat, in addition to enormous quantities of oats, barley, rye, flax and mixed grains. The aggregate value of all this grain production was $10,300,000,000. And please remember that the total number of farm families at the peak was only about one-quarter of a million.

RECENT WEATHER HISTORY

The weather history of this country shows that dry years and wet years come in irregular series. From 1885 to 1895 there was a period of eleven dry years, the highest rainfall being 11.98 inches in 1888, and the lowest being 5.47 inches in 1886. This was followed by seven years of ample rainfall from 1896 to 1902, during which time the minimum annual rainfall was 13.68 inches and the maximum 22.28 inches. From 1903 to 1910, an eight-year period of dry years occurred, in only one year of which the precipitation exceeded 9.9 inches. A wet period occurred from 1911 to 1917, the exception being 1912 when only 9.7 inches of rain fell. From 1918 to 1924 rainfall was under 12 inches each year except in 1921 and 1923, when slightly more than that fell. Satisfactory moisture occurred from 1925 to 1928. From 1929 up until the present a prolonged dry spell has occurred, an exception being 1932.

Agriculture is a continual struggle with nature and this is particularly true with farming in pioneer countries. Here in our own prairie land our wealth comes principally from agriculture and consequently all of us should have an intelligent interest in what is going on in the farming regions. The weather affords our farmers the most vexing problem of all. In the better regions the intelligent, adaptable, foresighted farmer has opportunities for success. In the areas of persistent and intense drouth, where the average rainfall is around 10 to 11 inches, the chances of failure from lack of moisture are too great for grain farming to be economic. It would be better for the settlers, the province, and for the land itself, if these areas were restricted to a form of agriculture in which ranching fills a predominant place.



A conception of the "Palliser Triangle" which differs from the outline to which most students of the subject adhere. The usual practice is to run the line northwest from Waterton to Bow Fort (near Banff) and thence to Coronation.